BRIEFER ARTICLES.

VARIATION IN LEAF ARRANGEMENT IN A MAPLE.

SOME weeks ago my attention was called by a colleague here to a young maple tree growing against the south wall of one of the college buildings. This young tree, perhaps ten years old, is limited in its direction of growth by its position, and it receives direct sunlight only when the sun is sufficiently high to shine over the flight of stone steps just east of it. Thus it has only a partial eastern exposure, no northern exposure, and is free only at the south and west. Naturally the tree is unsymmetrical and leans southward, away from the building. Evidently, too, the tree has undergone hardship other than that of unfavorable, or at least limited position, for it has no main stem, and its two or three largest branches do not balance well.

Of these larger branches one is remarkable in the arrangement of leaves and branchlets. The leaf arrangement of this tree is normally opposite, the pairs of leaves alternating regularly, and bearing a bud in each axil. The buds of former years have developed normally, in pairs and alternating. One branch, however, pointing southward and upward at an angle of about 45°, bears leaves and branchlets in threes, the whorls of three alternating regularly, so that the leaves and branches do not stand directly over one another. The branchlets, on the contrary, bear leaves in pairs, regularly alternating and therefore typical in arrangement.

On examining the lateral buds which are borne in the axils of the leaves developed in whorls of three, one sees a possible reason for such a diversity in the phyllotaxy of the branch and of its branchlets. Obviously each axillary bud develops in a space limited by two opposite organs, branch and leaf, capable of offering a certain amount of resistance to any structure developing between them. But on the other two sides no such resistance can be offered, for there is no older and stronger structure. It is true that the base of the petiole of the maple leaf is concave on the upper side, and that it clasps the branch more or less; but obviously far more resistance can be offered to the

growth of a bud and of any of its coverings from the moment of their origin as papillæ on the side of a growing-point, by the branch and the part of the petiole opposite it, than by the thinner, weaker, and really more distant opposite sides of the more or less clasping concave petiole. Examination shows that the outermost bud scales of all the lateral buds of this little tree, whether these buds are borne on the branches with paired leaves or on the one with leaves in whorls of three, are invariably opposite the spaces between branch and petiole, only the bud scales of the second and next inner pair being opposite the branch and petiole. Similar examination of the terminal bud of a branch with paired leaves shows that its outer pair of bud scales are alternate with the preceding pair of leaves, and its paired bud scales are regularly alternate, suggesting the regularity in arrangement of the parts within, and promising a continuance of the regularity in the branch which will develop therefrom next year.

On the other hand, the terminal bud of the one branch bearing its leaves in whorls of three has bud scales in whorls of three, the scales of the outer whorl alternating in position with the three leaves immediately behind this terminal bud, the bud scales of the succeeding whorls alternating regularly, and thus suggesting the same arrangement for the parts within, and prophesying a continuance of this arrangement of leaves on the nodes to be separated by growth of the internodes, and on the nodes to be formed, next season.

It seems to me, therefore, that in this little tree we have not only an interesting case of variation, but also an illustration of those influences — be they merely mechanical, as Schumann[1] would claim, or due rather to the arrangement of the deeper-lying conducting-tissues and hence connected with nutrition — which, if they do not altogether control, at least strongly influence the arrangement of the leaves and other structures formed at successive nodes. I am unable to discover any indications of what might have caused the different leaf-arrangement in the bud from which the present branch bearing leaves in threes has developed. It is of course easy to speculate as to possible causes, and perhaps if the branch were cut off, and examined microscopically at the base, evidences of the cause of the present difference might be found; but there are reasons which seem to me sufficient, for allowing this branch to grow on unmeddled with. We have then the variation, its cause being unknown. In the regular alternation of the leaves and the

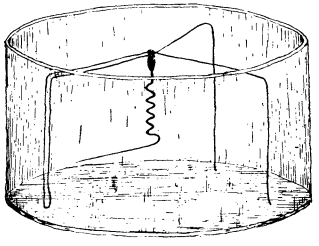
[1] Morphologische Studien, Heft I: Die Blattstellungen in gewundenen zeilen.

bud scales, whether in threes or twos, we have at least a suggestion that the "sport" was caused by the same influences which continue to affect if not to effect the alternation; namely, on the one hand, the mechanical resistance which the growing papillæ, which develop into leaves or branches, would encounter were they to grow in certain easily recognized directions, and their freedom from this resistance if growing in other directions; or, on the other hand, the disposal of the subjacent conducting-tissues, which would affect the nutrition of the vegetating point, and so might favor the formation and growth of leaf and branch papillæ (*Anlagen*) in positions alternate rather than opposite to older or already developed parts.—GEORGE J. PEIRCE, *Stanford University*.

HYGROMETER MADE WITH ERODIUM AWNS.

[THE following letter, together with some Erodium awns, was sent me a short time ago by Mr. Walter R. Shaw. I find upon trial that the awns are admirably fitted for the purpose indicated, and that the construction of an efficient hygrometer with them is a simple operation. Believing that others will be glad to make use of this method of demonstration, I have asked the privilege of publishing the letter and the sketch that accompanied it.—J. C. ARTHUR.]

I have found the awns of *Erodium cicutarium* an excellent substitute for those of Stipa in the Darwin transpiration hygrometer. Erodium is very common in some parts of California. A piece of iron wire bent in the form of a tripod serves to support the awns in the crystallizing dishes better than the mechanical cross bars that were supplied some time ago. The seed on the awn is easily attached to the tripod by a small bit of wax or paraffin with a hot needle. The tripod has the advantage that it may be instantly revolved to any position inside the dish without throwing the awn out of the axis of the vessel. The Erodium awn carries its own pointer. On the whole, less dexterity is required in its manipulation, and it has been shown to be more sensitive to humidity than the longer awns of Stipa.—WALTER R. SHAW, *Stanford University*.



Hygrometer made with crystallizing dish, in which an Erodium awn is supported on a tripod formed by bending a single piece of iron wire.